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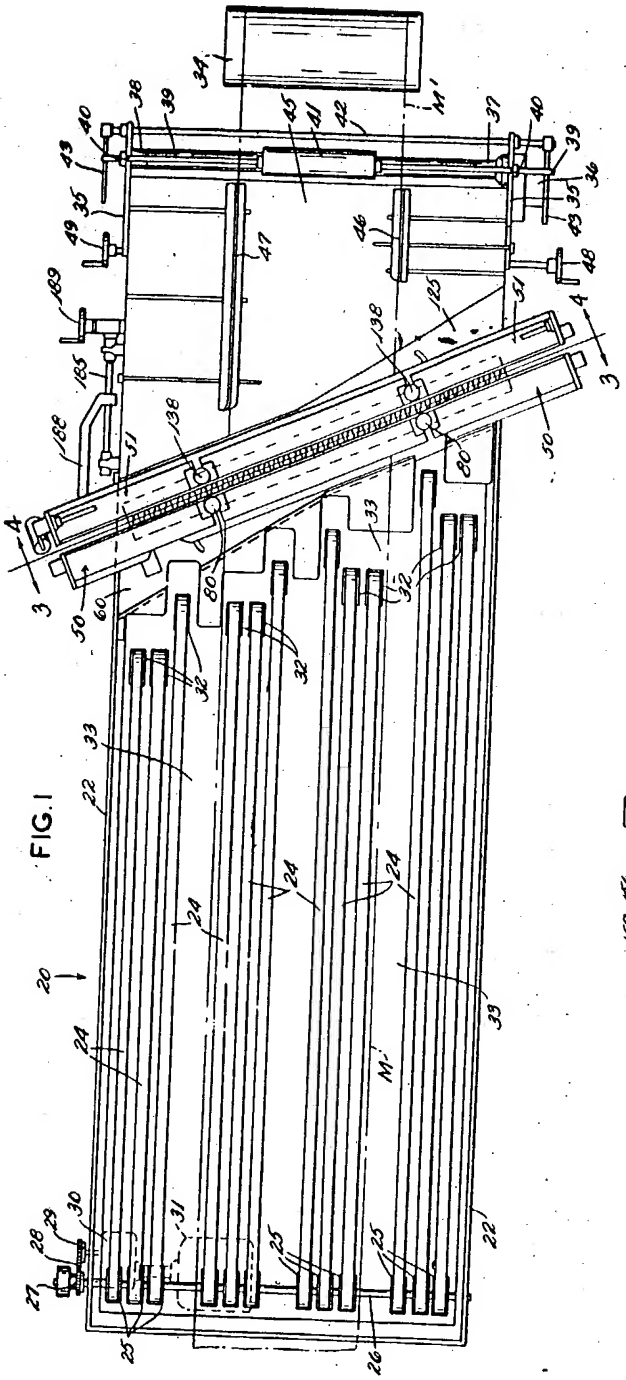

FIG. 1

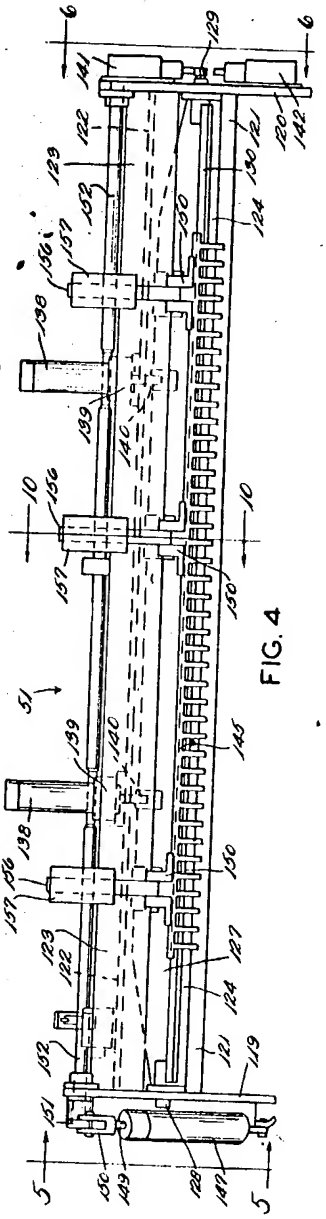

FIG. 4

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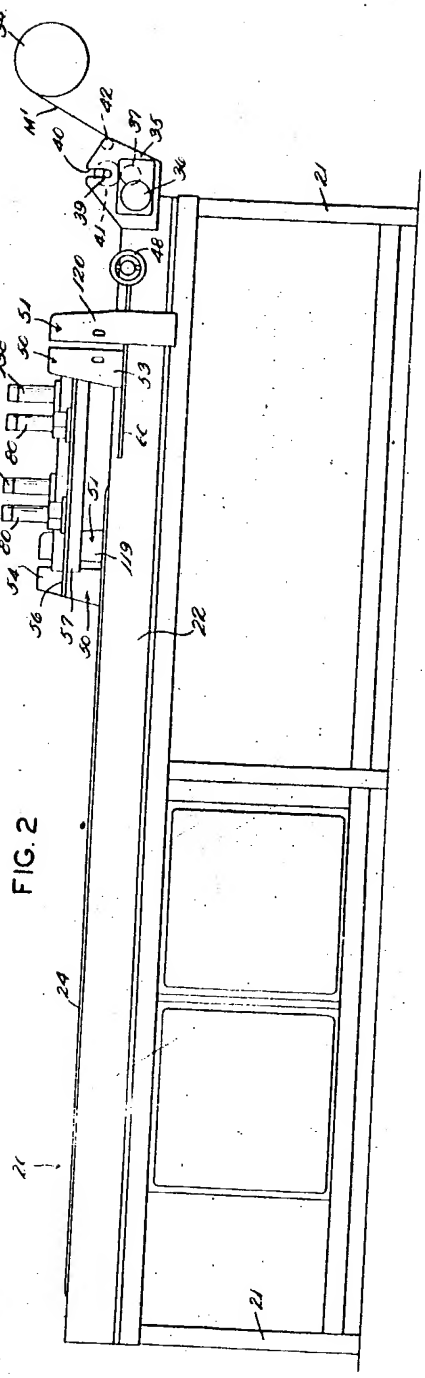

FIG. 2

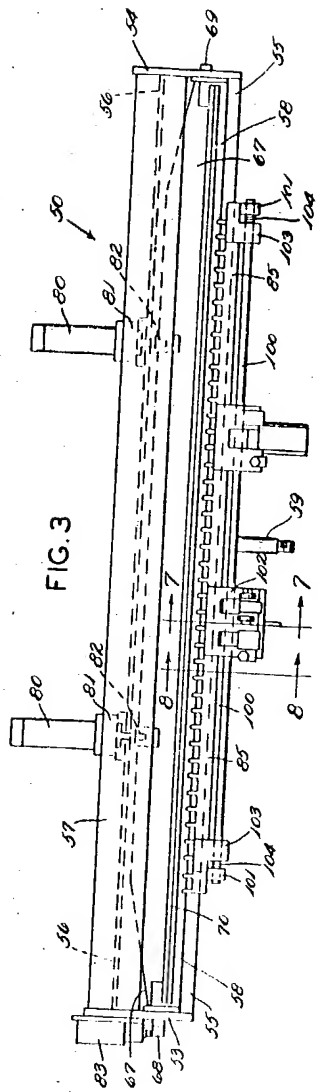

FIG. 3

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FIG. 5

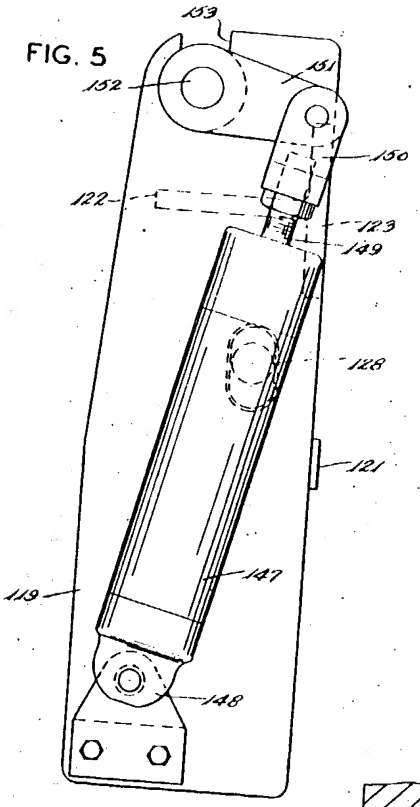


FIG.6

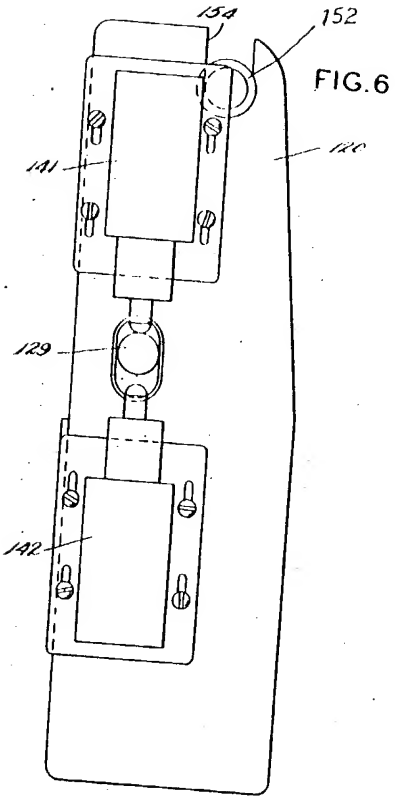
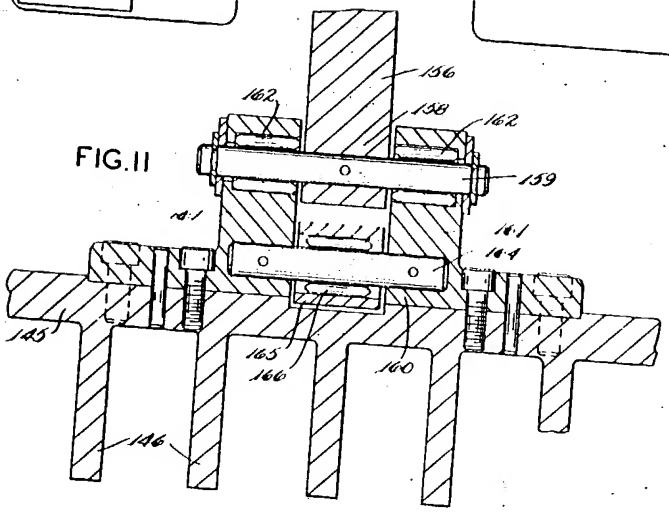


FIG.11



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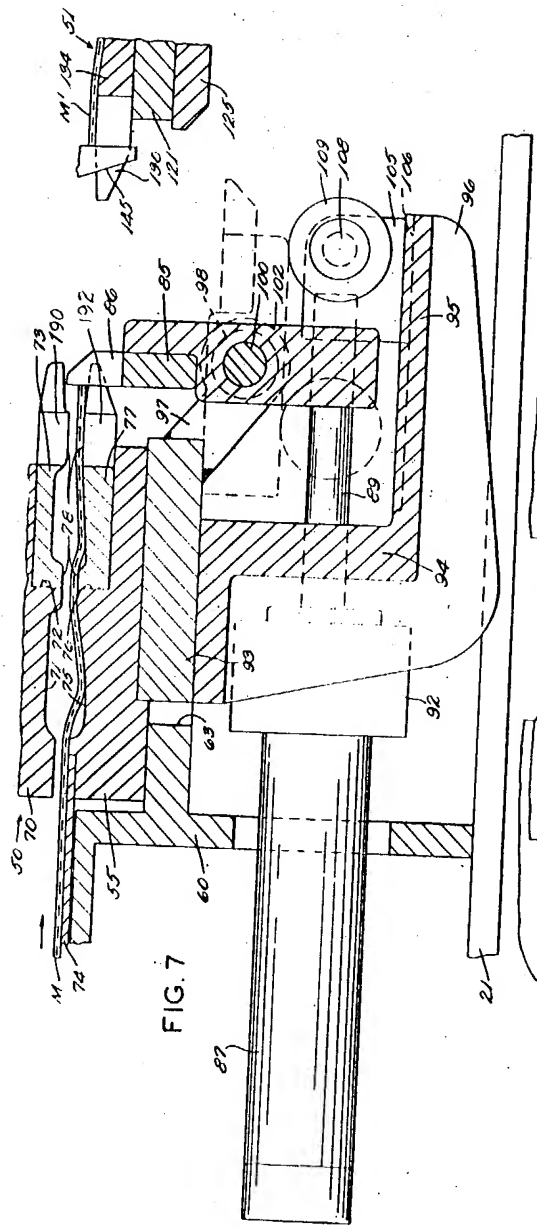

FIG. 7

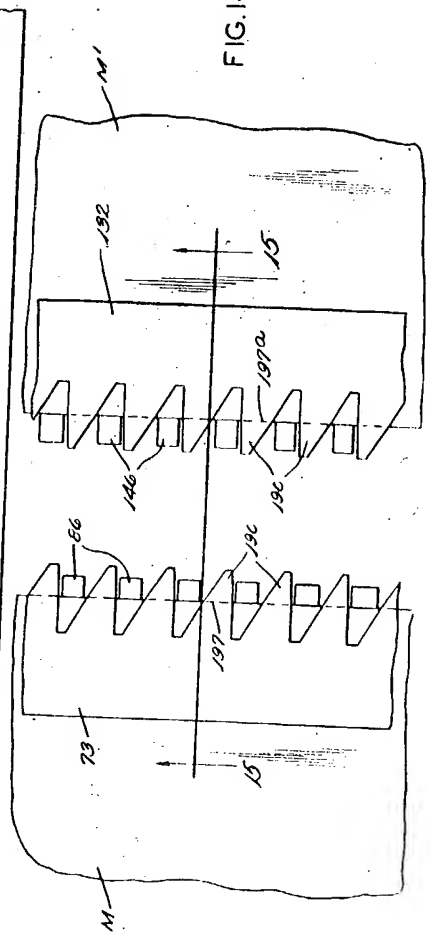

FIG. 14

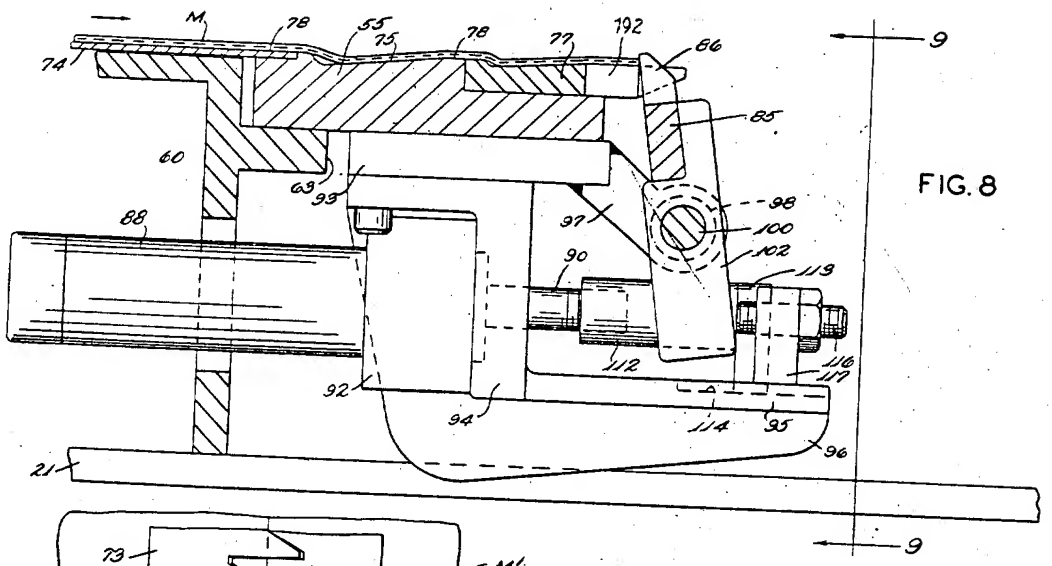

FIG. 8

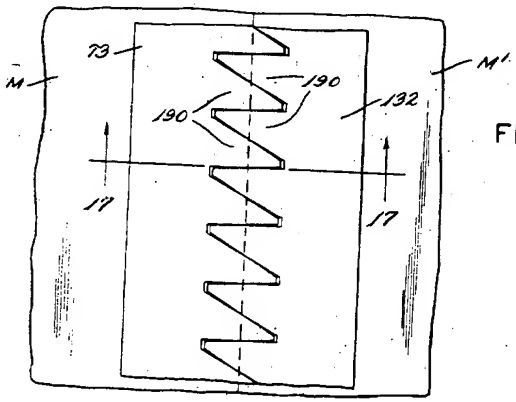

FIG. 16

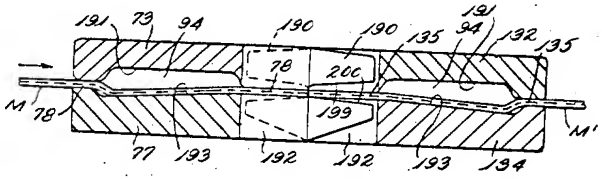

FIG. 17

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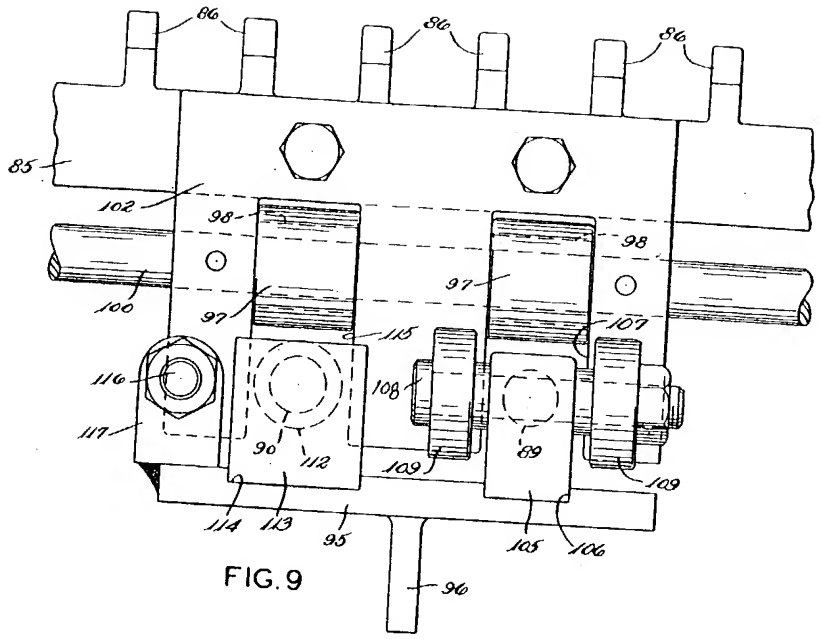
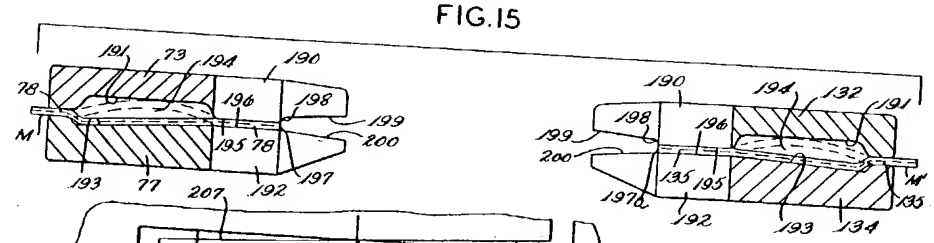


FIG. 9

FIG. 15



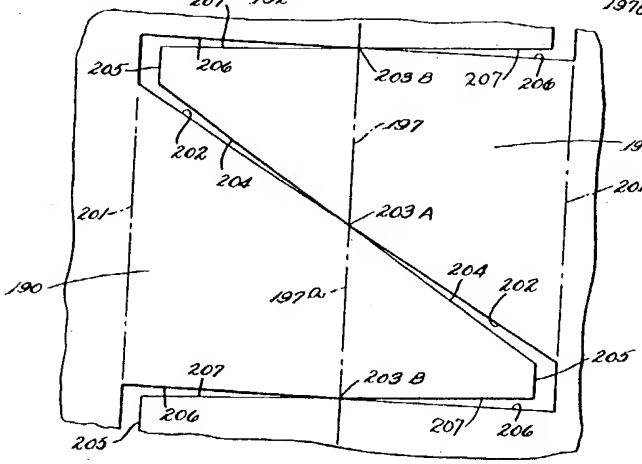


FIG. 18

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FIG. 19

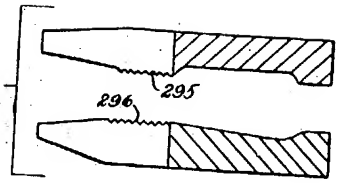

FIG. 10

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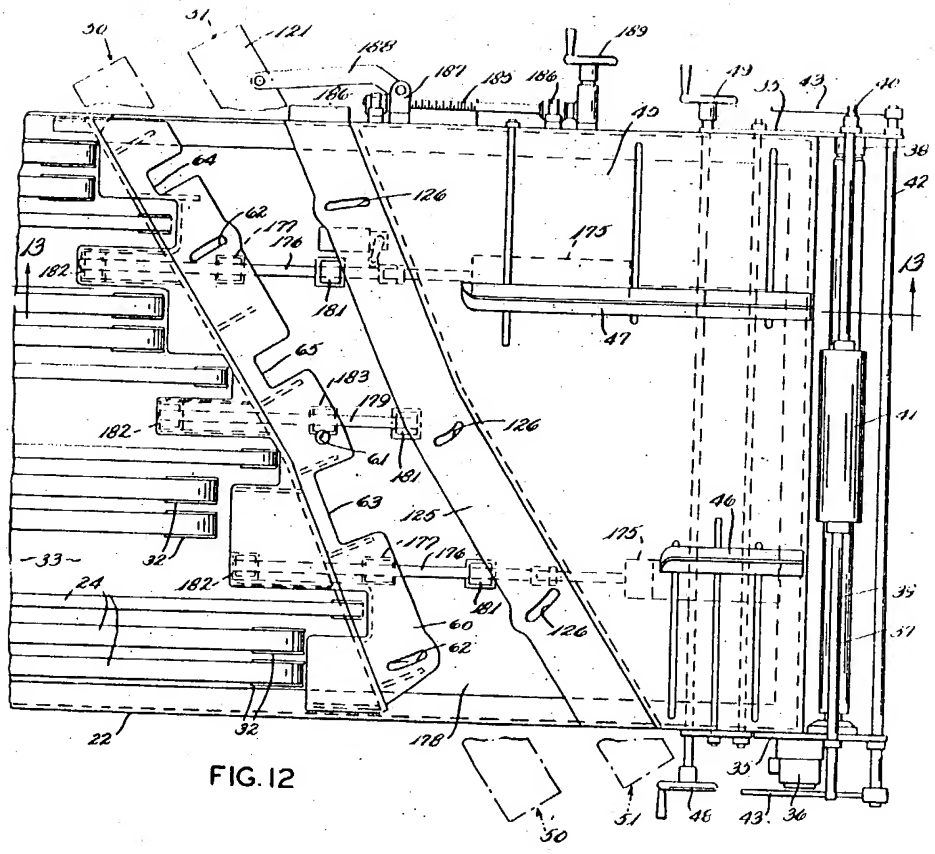
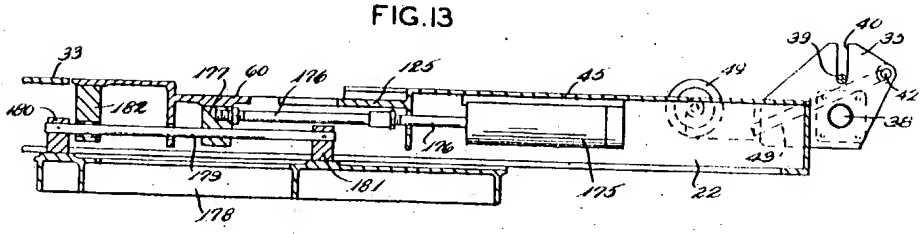


FIG. 12

FIG. 13



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Issued Jan. 9, 1962

CANADA DIV. 67

Patent No. 634,320

Apparatus for Butt Splicing Sheet Material

Wilhelm Brey, Cuyahoga Falls, Ohio, U.S.A., assignor to The Firestone Tire & Rubber Company, Akron, Ohio, U.S.A.

Application February 19, 1959, Serial No. 768,704
20 Claims

The present invention relates to a method and apparatus for butt splicing materials in sheet form. More particularly, the invention relates to a method and apparatus for joining in an automatic manner the trailing edge of one web of material, such as tire fabric, to the leading edge of a following web of material, also tire fabric.

The method and apparatus of the invention are particularly suited for butt-splicing the edges of self-adhesive rubberized fabric strips, such as bias-cut ply fabric which is used in the manufacture of pneumatic tires. As is well known in the manufacture of rubberized fabric ply material for use in tire construction, short strips of the ply fabric, which have been cut on a predetermined bias angle, are joined to form long and continuous webs. Heretore, the only practical way to build up continuous webs has been to overlap manually the ends of successive short strips and press the ends together. Such overlap splicing is costly and, even if performed accurately, contributes to irregularities in the weight and balance of the finished tire.

Therefore, it is an object of the present invention to provide an improved method and apparatus for joining materials in sheet form; particularly butt-splicing short lengths of rubberized, bias-cut tire fabric.

It is a further object to provide a method and apparatus which will automatically position, with a high degree of accuracy, the trailing edge of one web of material in relation to the leading edge of a following web of material, preliminary to a splicing operation.

More specifically, it is an object to provide a method and apparatus for butt-splicing the edges of adhesive sheet material, such as tire fabric, by clamping the edges along spaced segments and bringing the edges forcibly together with the clamped segments of each edge engaging the unclamped segments of the other edge.

Another object is to provide a method and apparatus for positioning and splicing the edges of two sheets of material, by preliminarily locating the trailing edge of one sheet adjacent to, but wholly back of a first reference line, positively forcing said trailing edge ahead to said first reference line, preliminarily locating the leading edge of said second sheet adjacent to, but wholly ahead of a second reference line, positively forcing said leading edge back to said second reference line, clamping said edges in said located positions and bringing said edges together to affect a butt-splice.

These and other objects of the invention, as well as the advantages thereof, will be apparent from the following description and drawings.

The method and apparatus of the present invention have the advantages of simplicity and effectiveness; the invention permits the manual operations of positioning and splicing the edges of sheet material to be performed rapidly and automatically.

In the drawings:

Fig. 1 is a plan view of apparatus embodying the invention;

Fig. 2 is an elevation of the apparatus shown in Fig. 1;

Fig. 3 is an enlarged elevation, taken substantially on line 3—3 of Fig. 1, showing the front or movable butt-splicing head;

Fig. 4 is an enlarged elevation, taken substantially on line 4—4 of Fig. 1, showing the rear or stationary butt-splicing head;

Fig. 5 is a further enlarged end view taken substantially on line 5—5 of Fig. 4;

Fig. 6 is an end view taken substantially on line 6—6 of Fig. 4;

Fig. 7 is an enlarged section taken substantially on line 7—7 of Fig. 3;

Fig. 8 is a section taken substantially on line 8—8 of Fig. 3, and with the locating member in the biased position;

Fig. 9 is a fragmentary front view of the structure taken on line 9—9 of Fig. 8;

Fig. 10 is an enlarged section taken substantially on line 10—10 of Fig. 4;

Fig. 11 is a front section taken substantially on line 11—11 of Fig. 10;

Fig. 12 is a plan view of the rear end of the apparatus table with both butt-splicing heads removed;

Fig. 13 is a section taken substantially on line 13—13 of Fig. 12;

Fig. 14 is a schematic plan view of the butt-splicing jaws when gripping the fabric webs;

Fig. 15 is an enlarged section taken substantially on line 15—15 of Fig. 14;

Fig. 16 is a view, similar to Fig. 14, when butt-splicing the fabric edges together;

Fig. 17 is a section taken substantially on line 17—17 of Fig. 16;

Fig. 18 is an enlarged fragmentary plan view of the butt-splicing teeth when intermeshed; and

Fig. 19 is an enlarged section of a pair of jaws, showing serrated clamping surfaces.

Referring now to the drawings, the preferred form of apparatus according to the invention is indicated generally by the numeral 20, and is intended to butt-splice individual strips of rubberized fabric material, cut in the form of parallelograms with the ends having a predetermined bias angle and form a continuous web. The apparatus 20 comprises a conveyor for the successive delivery of strips of material (M), means for winding the continuous web (M'), means for accurately positioning the leading edge of a strip and the trailing edge of the continuous web, means for clamping the positioned edges; and relatively movable pairs of jaws for butt-splicing the clamped edges.

The apparatus 20 includes a supporting frame 21 of suitable angle iron and plate construction. The top of the frame includes a generally rectangular box-like structure 22. Beneath the frame box 22 are mounted various switches, controls, a gear box and the front conveyor drive motor described below.

Referring to Fig. 1, the conveyor for strips of fabric (M) utilizes a multiple series of narrow width endless belts 24. At the front of the con-

veyor, each belt 24 is driven by an individual pulley 25 mounted on a common shaft 26 journaled in the frame box 22. One end of shaft 26 is fitted with a sprocket 27, connected by a chain 28 to another sprocket 29 on the output shaft of a gear box 30 driven by a two-speed electric motor 31. At the delivery end, each belt 24 rotates around an idler pulley 32. Between the belts 24, the frame box 22 has a cover plate 33.

Referring to Figs. 1 and 2, the reel 34 for winding the continuous web of fabric M' is located longitudinally of the rear end of the frame box 22. The reel 34 is demountable and driven by a variable speed electric motor (not shown) in a conventional manner. A slow rate of movement is obtained by utilization of a web drive mounted in a bracket 35 on the end of the frame box 22.

On one side of the bracket 35 is mounted a low-speed electric motor 36. The motor 36 drives a roll 37 journaled in the bracket 35. Opposite of the motor connection, the roll 37 is fitted with an overrunning clutch 38. A hold-down roll 41 is covered with a material, such as foam rubber, which will frictionally engage the continuous web M' without injury thereto. To the rear of shaft 39, another shaft 42 is journaled in the bracket 35. Attached to either end of the shaft 42 is a lever arm 43. The levers 43 extend downwardly below the slot 40 and beneath the ends of shaft 39. The levers 43 are used to lift the hold-down roll 41 from contact with the roll 37 when a web of fabric is being manually threaded therethrough after changing a reel 34.

The rear portion of the frame box 22 is provided with a cover plate 45. A pair of side guides 46 and 47, positioned by hand wheels 48 and 49, are adjustable over the surface of plate 45 to prevent lateral movement of the continuous web M'.

The apparatus 20 employs a pair of heads each mounting a pair of jaws, to accurately position, clamp and butt-splice the leading edge of a strip of material M to the trailing edge of a continuous web of material M' (Fig. 7). The front, or movable, head whose pair of jaws positions and clamps the leading edge of the successive strips M delivered by the conveyor belts 24, is indicated generally at 50. The rear, or stationary head whose pair of jaws positions and clamps the trailing edge of the continuous web M', is indicated generally at 51.

Referring to Fig. 3, the front head 50 includes an elongated rectangular structural member having vertical end plates 53 and 54 connected by a transverse base plate 55, medial plate 56 and face plate 57. Between the base plate 55 and the medial plate 56 is a throat, indicated at 58, through which the material passes. At approximately the midpoint of baseplate 55 is a head pivot and support pin 59.

Referring to Figs. 12 and 13, at the edge of the front cover plate 33, a stepped down movably mounted front head support table 60 extends diagonally across the frame box 22. The support table 60 has a bore 61 to receive the pivot pin 59. The support table also has a pair of angular slots 62 intended to receive bolts depending from the baseplate 55 so that the head 50, rotatable on the pivot pin 59, may be locked in a position corresponding to the bias angle of the fabric. The support table is further provided with relieved clearance areas 63, 64 and 65.

Referring again to Fig. 3, the front head 50 includes a generally rectangular clamp frame 67 have bearing pins 68 and 69 at either end. The end plates 53 and 54 are provided with short vertical slots to receive pins 68 and 69, respectively, allowing vertical movement of the clamp frame, as described below. An upper clamp bar 70 is attached to the underside of the frame 67 longitudinally thereof.

Referring to Fig. 7, the front portion of the under-surface of the clamp bar 70 is provided with a recess 71, generally rectangular in cross section and extending longitudinally of the bar, which facilitates positioning of the leading edge of strip M. The undersurface of the clamp bar is also provided with a shouldered recess 72, also extending the length of the clamp bar, in which is mounted the front upper toothed jaw 73. The clamp bar 70 is opposed by the head baseplate 55, resting on the support table 60. The upper surface of the baseplate 55 is provided with a forwardly extending slide plate 74, a sloping recess 75 opposite recess 71, and a shouldered recess 76. The toothed upper jaw-segment 73 is opposed by a similar, toothed lower jaw 77, mounted in recess 76. The material M is clamped between the toothed jaws in the areas 78.

Referring again to Fig. 3, the clamping action is obtained by a pair of fluid-operated cylinders 80 mounted vertically by flanges 81 attached to the upper side of the medial plate 56. The piston rod 82 of each cylinder 80 is connected to the upper edge of the clamp frame 67. When the cylinders 80 are energized to raise or lower the clamp frame 67, a limit switch 83 mounted on end plate 53 is actuated by pin 68.

Referring to Figs. 7 to 9, the leading edge of material M is accurately positioned between the jaws 73 and 77, on a predetermined reference line, by a pivoted locating member 85. The locating member 85 has a series of spaced fingers 86 adapted to interfit between the teeth of jaws 73 and 77 (see Fig. 14). Movement of the locating member 85 is controlled by fluid-operated cylinders 87 and 88. The two cylinders have rearwardly extensible piston rods 89 and 90, respectively. The cylinders are mounted in a block 92 which is part of a support bracket having a top plate 93 attached to the underside of the head baseplate 55. The bracket also includes a flange 94, depending from the top plate 93, and a rearwardly directed platform 95. The bracket structure is reinforced by a rib 96.

Depending from the rear edge of the bracket top-plate 93 are a pair of rearwardly inclined bearing supports 97. The supports 97 are fitted with anti-friction bearings 98 which rotatably mount the medial portion of a shaft 100 extending longitudinally of the head 50. As shown in Fig. 3, the ends of the shaft 100 are journaled in a pair of bearing supports 101. The shaft 100 carries a support member 102 and 103. The locating member 85 is attached to the upper forward surface of the members 102 and 103. The relieved area 64 in the support table 60 provides clearance for movement of the right bearing support 101 and member 103 when the bias angle of the heads 50 and 51 is adjusted. Between each bearing support 101 and member 103 is a coil spring 104 having its opposite ends secured to said bearing support and member, respectively, for biasing the shaft 100, so that the locating member 85 is always urged toward the head baseplate 55.

As shown in Figs. 7 and 9, the locating member 85 is pivoted rearwardly and lowered, compressing the coil springs 104, by retraction of the normally extended rod 89 of piston 87. The outer end of the rod 89 is fitted with a block 105 which slides in a groove 106 in the platform 95 through a clevis opening 107 in the support member 102. The block

105 has a pin 108 therethrough which is fitted at each end with an anti-friction bearing 109. When the piston rod 89 is retracted, the bearings 109 contact the member 102 and move the locating member 85 rearwardly and down, to the broken line position shown in Fig. 7.

As shown in Figs. 8 and 9, the locating member 85 is caused to pivot by the coil springs 104 when the normally retracted rod 90 of piston 88 is extended. The outer end of the rod 90 is fitted with a sleeve 112 terminating in a vertical block 113 which slides in a groove 114 in the platform 95.

The sleeve 112 extends through a clevis opening 115 in the support member 102, and when the rod 90 is extended, the action of the springs 104 will move the locating member 85 to the position shown in Fig. 8. The movement of the locating member is adjustably limited by a set screw 116 mounted in a bracket 117 on the platform 95 and contacting the support member 102.

Referring to Fig. 4, the rear head 51 includes an elongated rectangular structural member having vertical end plates 119 and 120 connected by a transverse base plate 121, medial plate 122 and face plate 123. Between the base plate 121 and the medial plate 122 is a throat, indicated at 124, through which the material passes.

Referring to Fig. 12, at the edge of the rear cover plate 45, a stepped-down rear head support table 125 extends diagonally across the frame box 22. The support table 125 has three angular slots 126 intended to receive bolts depending from the base plate 121 so that the rear head 51 may be locked in a position corresponding to the bias angle of the fabric end.

Referring again to Fig. 4, the rear head 51 also includes a generally rectangular clamp frame 127 having bearing pins 128 and 129, on either end. The end plates 119 and 120 are provided with short vertical slots to receive pins 128 and 129, respectively (Figs. 5 and 6). The slots which receive pins 128 and 129 are similar to the slots in end plates 53 and 54 which receive pins 68 and 69 of front clamp frame 67. An upper clamp bar 130 is attached to the underside of frame 127 longitudinally thereof.

Referring to Fig. 10, the undersurface of the clamp bar 130 is provided with a longitudinally extending shouldered recess 131 in which is mounted the rear upper jaw 132. The clamp bar 130 is opposed by the head baseplate 121 resting on the support table 125. The upper surface of the baseplate 121 is provided with a shouldered recess 133, in which is mounted the lower rear jaw 134. The material M' is clamped between the jaws 132 and 134 by the areas 135. The upper surface of the baseplate 121 is also provided with a recess 136, in which a plurality of ball casters 137 are mounted extending above the surface level of the cover plate 45.

Referring again to Fig. 4, the clamping action is obtained by a pair of fluid operated cylinders 138 mounted vertically by flanges 139 attached to the upper side of the medial plate 122. The piston rod 140 of each cylinder 138 is connected to the upper side of the clamp frame 127. When the cylinders 138 are energized to raise or lower the clamp frame 127, a pair of opposed limit switches 141 and 142 mounted on end plate 120 are actuated by pin 129 (Fig. 6).

As best shown in Fig. 10, the trailing edge of material M' is accurately positioned between the jaws 132 and 134, on a predetermined reference line, by a pivoted locating member 145. The locating member 145 has a series of spaced fingers 146 which interfit between the teeth of the jaws 132 and 134 (see Fig. 14).

Referring to Fig. 5, movement of the locating member 145 is controlled by a fluid-operated cylinder 147 which has a base clevis 148 pivotally mounted on end plate 119. The upwardly extensible piston rod 149 is fitted with a clevis 150 pivotally fastened to a lever 151. The lever 151 is attached to a shaft 152 which is journaled at one end in a slot 154 in end plate 120 and at the other end in a slot 153 in end plate 119.

Referring to Figs. 4, 10 and 11, when the cylinder 147 is actuated, the resulting movement of the shaft 152 is transmitted to the locating member 145 by a linkage mechanism which includes gear segments 155. The gear segments 155 engage vertically movable racks 156 carried by rack guides 157 mounted on the front surface of the head face plate 123. The lower end of each rack 156 is provided with a boss 158 through which is inserted an upper pivot pin 159.

As best shown in Fig. 11, each pin 159 carries a support member 160 having identical clevis portions 161 which rotate on anti-friction bearings 162 on the pin 159. Below the pin 159 is a second pivot pin 164 on which is mounted the lower end of a link 165 which rotates on an anti-friction bearing 166.

Referring to Fig. 10, the upper end of each link 165 rotates on an anti-friction bearing 167 mounted around a link pivot pin 168. The pivot pin 168 is mounted in the clevis opening 169 of a link bracket 170 attached to the head medial plate 122. Each bracket 170 is also provided with an adjustable screw 171, which extends through a slot 172 in the clamp frame 127 and contacts the support member 160 so as to limit inward movement of the locating member 145.

Referring to Figs. 12 and 13, the front head 50 and the support table 60 are moved toward the stationary rear head 51 and the support table 125 by a pair of fluid operated cylinders 175 mounted within the box frame 22 beneath the rear cover plate 45. The end of the piston rod 176 of each cylinder is fastened in a push block 177 mounted on the rear undersurface of the support table 60.

The table structure of the apparatus 20 is strengthened by a support plate 178 beneath the box frame 22. The plate 178 is carried by rods 179 each mounted between blocks 180 and 181. The forward end of each rod 179 is supported by a hanger block 182 mounted on the forward undersurface of the table 60. The rear end of each outer rod 179 is supported by a push block 177. The rear end of the middle rod 179 is supported by a hanger block 183.

The angle of the heads 50 and 51 is changed by first extending the piston rods of cylinders 175 so that the jaws are in contact with each other, as shown in Fig. 1. The bolts depending through the slots 62 and 126 are then loosened. As shown in Fig. 12, a threaded shaft 185 is mounted in a pair of brackets 186 on one side of the box frame 22. A threaded block 187, having a lever 188 attached to the rear head baseplate 121, is fitted on the shaft 185. When the shaft 185 is rotated by a handwheel 189, the angle of the heads on their respective support tables, 60 and 125, can be simultaneously changed so that the heads are parallel.

As best shown in Fig. 15, the front and rear toothed upper jaws 73 and 132 are identical, each having teeth 190 and a recess 191 of generally rectangular cross section extending longitudinally of the jaw. The lower jaws 77 and 134 are also

identical having teeth 192 and a sloping recess 193 facing recess 191, thus forming a space 194.

The teeth 190 and 192 are provided with substantially parallel clamping surfaces 195 and 196, respectively. The clamping surfaces of the teeth may be serrated or otherwise treated to prevent slippage, as shown, for example, at 295 and 296 in Fig. 19. The material is accurately located between surfaces 195 and 196 by the locating members 85 and 145, respectively. The surfaces 195 and 196 terminate at reference lines indicated, respectively, at 197 and 197a, extending longitudinally of the segment bodies. As shown in full lines in Fig. 15, the material has been accurately located at the reference lines 197-197a by the locating members 85. If the material is slightly out of position prior to final alignment by the locating members, the spaces 194 will permit the material to change position slightly, as shown in dotted lines. At the reference lines 197 and 197a, the under surface of each tooth 190 is provided with a shoulder 198, and outwardly thereof with a divergent portion 199, inclined upwardly at an angle of, for example, 5°, so that the material may be butt-spliced without pinching or injury. Outwardly of the surface 196, the upper surface of each tooth 192 is provided with a divergent portion 200 inclined downwardly at an angle of, for example, 5°.

Referring to Fig. 18, the teeth 190 and 192 are identical in plan view. From the imaginary base line 201, a flat surface 202 extends outwardly at an angle of, for example, 29°-45°, terminating at a contact point 203A which is directly above the reference lines. Outwardly of contact point 203A, the surface 204 is inclined further, for example, an additional 3°. The surface 204 terminates in a short surface 205 which is substantially parallel to the base line 201.

On the other side of each tooth 190 or 192 is a flat surface 206 at right angles to the base line 201. The surface 206 terminates at a contact point 203B, which is also directly above the reference line. Outwardly of contact point 203B, the surface 207 is inclined toward surface 205 at an angle of, for example, 3°. Thus the teeth, when the pairs of jaws are moved toward each other, abut only at contact points 203A and 203B.

The teeth of the opposed butt-splicing jaws being staggered, it will be seen that, upon moving the closed jaws toward each other, the teeth will mesh, carrying the opposed clamped fabric edges with them. Since the reference lines 197-197a (see Fig. 18) coincide substantially with the fabric edges, meshing of the teeth will force the clamped fabric edges tightly together in a butt-splice, with the clamped segments of each edge engaging the unclamped segments of the other edge (see Fig. 17).

Since the actual butt-splicing occurs along the reference line 197-197a, it will be apparent that the teeth 190 may vary in configuration and size. Applicant has found that extending the teeth 190 a substantial distance beyond the reference lines 197 and 197a provides meshing guide-or pilot-portions, thus insuring correct alignment and positioning of the butt-splicing jaws.

Operation of the Apparatus and Control Therefor

The various elements of the apparatus 20, as described above, are actuated in timed sequences by suitable controls so that the leading edge of the strip M is joined to the trailing edge of the continuous web M' in an automatic manner.

An operating cycle of the apparatus includes the following steps:

1. The belts 24 are run at relatively high speed by the motor 31 to deliver a strip of material M to the front head 50. The drive motor of the reel 34 is run at relatively high speed to wind up the web of material M'.

2. As the leading edge of the strip M approaches the jaws of front head 50, a switch (not shown), located above the belts 24, slows the motor 31 and, thereby the belts 24, to a lower speed.

3. As the trailing edge of the material M' passes beneath the front head 50 and approaches the rear head 51, a first photoelectric cell (not shown) is energized. This first photoelectric cell causes (a) stopping of the drive motor of reel 34 and allows the motor 36 to drive the roll 37 at a lower speed and (b) extension of the rod 89 of piston 87 so that the fingers of the locating member 85 are biased to a vertical position by the springs 104 (see Fig. 7).

4. As the leading end of the strip M is delivered at low speed through the throat 58 of head 50 and emerges between the teeth of jaws 73 and 77, the first photoelectric cell is deenergized, which stops the belts 24 by completely stopping motor 31, thus preliminarily locating the leading edge of the strip M wholly ahead of a reference line 197.

5. As the trailing end of the material M' approaches the throat 124 of head 51 at low speed and passes between the teeth of jaws 132 and 134, a second photoelectric cell (not shown) is energized. This second photoelectric cell causes (a) stopping of the motor 36, thus preliminarily locating the trailing edge of the material M' wholly behind a second reference line 197a, (b) extension of the rod 90 of piston 88, so that the fingers of the locating member 85 is biased to push the leading edge of strip M accurately back on the reference line 197 and between the jaws 73 and 77 (see Fig. 8), (c) extension of the rod 149 of cylinder 147 so that the fingers of the locating member 145 are pivoted and lowered to push the trailing edge of the material M' accurately forward on the reference line 197a and between the jaws 132 and 134 (see Fig. 10) and (d) starting of a timer (not shown).

6. After a first delay period, the timer initiates—(a) extension of the rods 82 of cylinders 80 so that the clamp bar 70 of front head 50 is lowered to clamp the strip M along spaced segments between the areas 78, and (b) extension of the rods 140 of cylinders 138 to lower the clamp bar 130 of rear head 51 to clamp the material M' along spaced segments between the the areas 135. The clamping action exerts sufficient squeezing pressure so that the edges of the material actually will extend toward each other a very slight distance.

7. After the clamping action, the timer further initiates—(a) retraction of the rods of cylinders 87 and 88 to lower the locating member 85, and (b) retraction of the rod of cylinder 147 to raise the locating member 145.

8. After lowering locating member 85 and raising locating member 145, the timer further causes retraction of the rods 176 of cylinders 175, so that the jaw pair 73-77 of front head 50 is moved toward and into engagement with the jaw pair 132-134 of rear head 51, thus butt-splicing the leading edge of strip M to the trailing edge of continuous web M' (see Fig. 17).

9. After the butt-splicing, the timer further causes retraction of the rods of cylinders 80 and 138, which raises the clamp bars 70 and 130, thereby leaving throats 58 and 124 unobstructed.

10. After release of the clamp bars, the timer further causes—(a) extension of the rods of cylinders 175 so that the heads 50 and 51 are separated

(b) starting of motor 31 to run the belts 24 at relatively high speed, and (c) starting the motor of reel 34 to run at relatively high speed.

The cycle may now be repeated.

It is apparent that performance of steps 6 to 10 of the operating cycle, as controlled by a timer, should occur in the described sequence. Accordingly, suitable limit switches are preferably employed to monitor occurrence of the several cycle steps. For example, the limit switch 83 signals the completion of step 9. The limit switch 142 is employed to signal the timer that step 6 has been completed and step 7 may begin. Switch 141 also signals completion of step 9. A switch, actuated by rotation of the shaft 100, signals completion of step 7. These and other controls will readily suggest themselves to those skilled in the art.

While a preferred embodiment of apparatus, especially adapted for butt-splicing tire fabric on the bias angle, has been shown and described, it is apparent butt-splicing may be done at any angle and that other self-adhesive materials could also be joined. Also, the invention has proven satisfactory for joining tire fabric in which the reinforcing elements comprise wires or cables, rather than fabric. Therefore, the scope of the invention is limited only by the subjoined claims.

Claims:

1. The method of butt-splicing the edges of two lengths of rubberized fabric, comprising clamping one edge along spaced segments, clamping the other along spaced segments, and bringing the two edges forcibly together with the clamped segments of one edge engaging the unclamped segments of the other edge.

2. The method of butt-splicing the edges of two lengths of rubberized fabric, comprising positively clamping one edge along spaced segments, positively clamping the other along spaced segments, and bringing the two edges forcibly together with the clamped segments of one edge engaging the unclamped segments of the other edge.

3. Apparatus for butt-splicing the edges of two lengths of rubberized fabric, comprising a pair of jaws clamping one edge along spaced segments, a second pair of jaws clamping the other edge along spaced segments, and means to bring said pairs of jaws together and urge said clamped edges into forcible engagement, with the clamped segments of one edge contacting the unclamped segments of the other edge.

4. Apparatus for butt-splicing the edges of two lengths of rubberized fabric, comprising a pair of jaws positively clamping one edge along spaced segments, a second pair of jaws positively clamping the other edge along spaced segments, and means to bring said pairs of jaws together and urge said clamped edges into forcible engagement, with the clamped segments of one edge contacting the unclamped segments of the other edge.

5. Apparatus according to Claim 4, in which each of said jaws has a serrated clamping surface.

6. Apparatus according to Claim 5, in which said clamping jaws have at least one surface tapered toward said edges.

7. Apparatus according to Claims 4, 5 or 6 in which said pairs of clamping jaws include a plurality of laterally spaced teeth, with the teeth of one pair of jaws alternating with the teeth of said other pair of jaws and with said edges clamped by said teeth intermediate the ends and the bases thereof.

8. Apparatus according to claims 4, 5 or 6 in which said pairs of clamping jaws include a plurality of laterally spaced teeth, with the teeth of one pair of jaws alternating and intermeshing with the teeth of said other pair of jaws and with said edges clamped by said teeth intermediate the ends and the bases thereof.

9. Apparatus according to Claims 4, 5 or 6 in which said pairs of clamping jaws include a plurality of laterally spaced teeth, with the teeth of one pair of jaws intermeshing with and contacting the teeth of said other pair of jaws at points lying on the splice line of said two lengths of fabric.

10. Apparatus for accurately locating the edge of a length of material, which comprises a surface supporting said edge, means movable toward said surface to move said edge inwardly thereon, said surface having a recess permitting said material to distort as said edge is moved.

11. Apparatus for accurately locating the edge of a length of rubberized fabric, which comprises a surface supporting said edge and terminating in a plurality of spaced teeth, means interfitting between said teeth and movable toward said surface to move said edge inwardly thereon, said surface having a recess permitting said fabric to distort as said edge is moved.

12. The method of accurately locating the edges of two lengths of rubberized fabric, comprising preliminarily locating the edge of said first length adjacent a reference line, positively moving said first edge to said first reference line, preliminarily locating the edge of said second length adjacent a second reference line, and positively moving said second edge to said second reference line.

13. The method of accurately locating the edges of two lengths of rubberized fabric for a subsequent splicing operation, comprising preliminarily locating the trailing edge of said first length adjacent to but wholly back of a first reference line, positively forcing said trailing edge ahead to said first reference line, preliminarily locating the leading edge of said second length adjacent to but wholly ahead of a second reference line, and positively forcing said leading edge back to said second reference line.

14. The method of butt-splicing two lengths of rubberized fabric, comprising preliminarily locating the trailing edge of said first length adjacent to but wholly back of a first reference line, positively forcing said trailing edge ahead to said first reference line, preliminarily locating the leading edge of said second length adjacent to but wholly ahead of a second reference line, positively forcing said leading edge back to said second reference line, clamping said edges, and bringing said edges forcibly together.

15. The method of butt-splicing two lengths of rubberized fabric, comprising preliminarily locating the trailing edge of said first length adjacent to but wholly back of a first reference line, positively forcing said trailing edge ahead to said first reference line, preliminarily locating the leading edge of said second length adjacent to but wholly ahead of a second reference line, positively forcing said leading edge back to said second reference line, clamping said trailing edge along spaced segments at said first reference line, clamping said leading edge along spaced segments at said second reference line, and bringing the two edges together with the clamped segments of one edge engaging the unclamped segments of the other edge.

16. The method of butt-splicing two lengths of rubberized fabric, comprising preliminarily locating the trailing edge of said first length adjacent to but wholly back of a first reference line, positively

forcing said trailing edge ahead to said reference line, preliminarily locating the leading edge of said second length adjacent to but wholly ahead of a second reference line, positively forcing said leading edge back to said second reference line, positively clamping said trailing edge along spaced segments at said first reference line, positively clamping said leading edge along spaced segments at said second reference line, and bringing the two edges together with the clamped segments of one edge engaging the unclamped segments of the other edge.

17. Apparatus for butt-splicing two lengths of rubberized fabric comprising, first stop means for preliminarily locating the trailing edge of said first length adjacent to but wholly back of a first reference line, first locating means movable into engagement with said trailing edge to force it ahead to said first reference line, second stop means for preliminarily locating the leading edge of said second length adjacent to but wholly ahead of a second reference line, second locating means movable into engagement with said leading edge to force it back to said second reference line, jaws clamping said trailing edge along spaced segments at said first reference line, jaws clamping said leading edge along spaced segments at said second reference line, and means to bring said jaws together to force the clamped segments of one edge into forcible engagement with the unclamped segments of the other edge.

18. Apparatus for butt-splicing two lengths of rubberized fabric, comprising a reel for said first length of material, means for stopping said reel with the trailing edge of said material adjacent to but wholly back of a first reference line, first locating means for moving said trailing edge ahead to said first reference line, delivery means for said second length of material, means for stopping said delivery means with the leading edge of said material adjacent to but wholly ahead of a second reference line, second locating means for moving said leading edge back to said second reference line, clamping means to grip said edges, and means for bringing said clamped edges forcibly together.

19. Apparatus for butt-splicing the edges of two strips of material, comprising relatively movable clamping means for said edges, means for accurately locating said edges in parallel relationship within said clamping means, means for actuating said clamping means to clamp said edges as so located, means for moving said clamping means relative each other to bring said edges into engagement.

20. Apparatus for butt-splicing the edges of two strips of material, comprising pairs of relatively movable clamping jaws for said edges, locating members for accurately locating said edges in parallel relationship within said clamping jaws, means for actuating said clamping jaws to clamp said edges as so located, means for moving said pairs of clamping jaws toward each other to bring said edges into forcible engagement, said jaws having intermeshing teeth, and said locating members having fingers interfitting between said teeth during said locating action.

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